TOM UDALL
SENATOR FOR NEW MEXICO

CONFERENCE REPORT

Policy Options from the New Mexico Water Resources Research Institute's 57th Annual New Mexico Water Conference
Hard Choices: Adapting Policy and Management to Water Scarcity
Co-Hosted by New Mexico State University and United States Senator Tom Udall

This conference report is a discussion of a variety of policy options proposed by participants and attendees of the New Mexico Water Resources Research Institute's 57th Annual Water Conference titled *Hard Choices: Adapting Policy and Management to Water Scarcity*. The conference in August 2012 featured five panel discussions and solicited input from all attendees to submit policy ideas for discussion. Following the conference, I directed my staff to work with a diverse group of water policy experts to put this document together to record the policy options for consideration by the public and policy makers.

As we adapt to our ongoing drought and a future where drought may become more frequent in New Mexico and the Southwest, I will look to this conference report as a resource, and I encourage further engagement and feedback from New Mexicans. I would like to thank the New Mexico Water Resources Research Institute Interim Director Sam Fernald and his staff for their tremendous assistance, along with other experts representing agricultural, municipal, environmental, state, federal and tribal stakeholders.

I feel strongly that working collaboratively is the key to overcoming our collective water challenges. I will strive to carry on the Western tradition of leadership on water issues to best serve New Mexico and the United States.

Tom Udall
United States Senator

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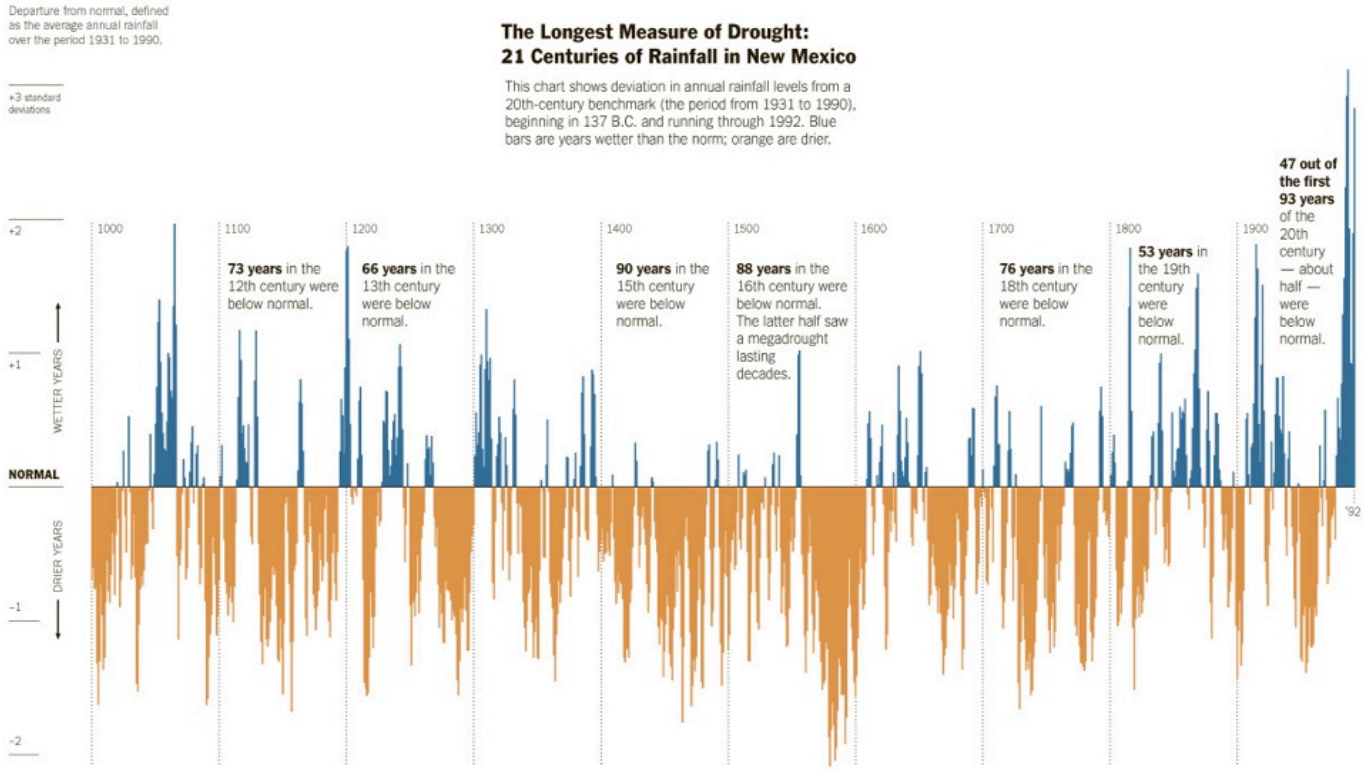
Prologue

The information and proposed actions in this document represent a comprehensive discussion of current and near-future water issues as articulated by regional experts and the public during the 2012 WRRI NM Water Conference. Although the issues range widely over supply, demand, conservation, technology and policy, a relatively simple reality emerges. It is likely to be drier in New Mexico in the decades to come than it has been in recent decades past, as the chart below suggests. By almost any measure, under current trends and trajectories, future water supply will not meet future water demand in New Mexico. Although supply can clearly be augmented in the future by conservation, improved policy and management, and new technologies, the evidence that emerges from the best New Mexico water science is that significant reduction in demand will be essential to meeting the constraints placed by smaller future supplies. Decades of relative water abundance in New Mexico and the region, coupled with large growth in local and regional populations and increased consumption, are leading us to a crisis point for water availability for residential, industrial, agricultural and environmental uses.



We cannot predict the future, but we can see clearly where robust, long-term trajectories are taking us. We must lay the groundwork now for long-term adaptation strategies while we have the relative luxury of still sufficient but declining water resources. It is crucial that we have strong and visionary leadership, good science, collaboration across sectors and disciplines, and cooperation among stakeholders in order to succeed.

I. RESEARCH, DATA, and MONITORING

The Secure Water Act

The Secure Water Act authorizes a national water census to determine the quantity of the nation's water resources, particularly in western areas where demand threatens supply and historical supply estimates may be inaccurate. The Act further includes study of lesser known groundwater resources. The Act was approved by Congress in 2009 as part of the Public Lands Omnibus package and authorized over $500 million in federal funds.

- **Proposed Action:** At the current pace, the Secure Water Act is behind schedule on funding. Current and future Administrations and Congresses should be continually educated on the importance of funding the Secure Water Act. This knowledge will help regions, states, and localities better plan for growth and water uses when they have a better understanding of the real limits to supply.

Energy and Water Nexus

New Mexico and the West are major sources of energy production, primarily oil, gas and coal mining. Energy resource extraction is a consumer of water as it is a power generator. The current extreme drought has adversely affected water resources needed for both purposes in various areas, creating potential conflicts with other uses. A range of new technologies and practices promise to increase recycling water in the energy sector which may reduce its water footprint. Further research on how water and energy resources are interconnected and the development of recycling technologies is needed.

- **Proposed Action:** Ongoing federal research efforts into this field are taking place, including at New Mexico's national laboratories. Sandia National Laboratories maintains a research program in this area, and the Department of Energy supports research as well. These efforts should be continued and Congress should consider reintroducing Senator Bingaman's Energy and Water Integration Act of 2011. That legislation would direct the Secretary of Energy to enter into an arrangement with the National Academy of Sciences to conduct an in-depth analysis of the impact of energy development and production on U.S. water resources, including reauthorizing the Water Desalination Act of 1996 through FY 2016. The legislation has been subject to hearings, but no further action. Senator Udall will ensure that this proposed legislative effort continues past Senator Bingaman's retirement.

Federal Water Monitoring Assets

The United States has the largest, most advanced water monitoring network in the world, from satellites orbiting in space to thousands of stream gauges in waterways large and small

throughout the nation. Data collected through National Oceanic and Atmospheric Administration (NOAA) and U.S. Geological Survey (USGS) are both a very valuable research tool and extremely beneficial to water users in the agricultural, municipal, and industrial sectors.

Unfortunately, recent fiscal pressures on federal spending have led to reductions in funding and the existing monitoring network is eroding. Long-term stream flow data are essential for good future water planning but now, as water is in decline, so too is our ability to collect the long-term data we need to better understand current dynamics and to better forecast future ones. USGS stream gauges in particular are being lost due to lack of operations and maintenance funding, threatening the integrity of historical records going back for many decades. Lack of USGS funding is leading the agency to enter into more and more private consulting contracts with water users and parties to existing water litigation, which may lead to a reduction in their independence going forward.

Several weather and climate monitoring satellites are aging and replacement capabilities are costly to develop and launch. NOAA and the National Aeronautics and Space Administration (NASA) are seeking to maintain their research and development capabilities, but data gaps are possible and future funding uncertain with both agencies facing cuts in the current fiscal environment.

- **Proposed Action:** restore funding priority for federal water monitoring assets, particularly high value and low cost assets like USGS stream gauges. Maintain U.S. weather and climate satellite monitoring capabilities. To underscore the importance of monitoring assets, more research should be applied directly to how they inform management decisions and policy. Funding for the National Integrated Drought Information System (NIDIS) should be reauthorized. NIDIS provides easily accessible drought information; it developed and currently operates the U.S. Drought Portal.

Transboundary Aquifer Assessment Program

The United States-Mexico Transboundary Aquifer Assessment Act authorizes $50 million for the period of FY 2007 through FY 2016 to assess priority transboundary aquifers systematically. Through this program, scientists from multiple universities, the USGS, state agencies, and Mexican counterparts have worked in partnership to collect and evaluate new and existing data to develop high-quality, comprehensive, groundwater data and flow models for bi-national aquifers. The program has developed new collaborations and data exchange between Mexican and U.S. collaborators that have provided an entirely new understanding of the aquifers that straddle the border, including enhanced appreciation of challenges to aquifer sustainability. The goal is to understand availability and water use and to evaluate strategies through sound, scientific analysis in order to protect water quality and enhance water supplies for sustainable economic development on the U.S.-Mexico border.

- **Proposed Action**: Funding for the ten-year program ended two years ago with only a small portion of the legislative funding being appropriated. With the interim report from USGS ready to be submitted to to Congress soon, additional efforts should be explored to fund the program, either in standalone legislation or included in existing legislation.

Additional Water Research Priorities

Participants at the 2012 NM WRRI NMSU – Udall Water Conference identified a variety of other high priority research topics. The likely support agencies for this research include the Department of the Interior and its bureaus such as the USGS, Department of Energy, and National Science Foundation. Important topics include:

- *Watershed and forestry research:* analysis of how forestry and forest management practices will impact water supply in local watersheds and regions, including modeling research on relationships between fire, forest thinning, and the resultant impacts on water supply.

- *Watershed supply modeling:* this has been an increasingly useful management tool for government authorities and water users in order to understand connections and trade-offs of watershed practices and water supply management strategies.

- *Southwest climate research:* regional climate studies help predict local impacts of climate change on Southwest water supplies, including Long Term Ecological Research Sites, such as the Jornada Basin and the Sevilleta in New Mexico, which are funded by the National Science Foundation.

    - **Proposed Action:** re-prioritization of agency resources and support for existing, unfunded programs like the Rio Grande Environmental Management Program to address these three research areas.

- *Water supply and growth:* the assumption of continued economic growth and resource consumption may be constrained by scarcity of water and other resources, and water conserved through greater efficiencies may encourage further growth. As water users become more efficient and their conserved water is applied elsewhere, all users have less excess water that could be conserved later, and so can be more vulnerable to natural, wide variations in the availability of the resource. This is called hardening of demand, and, just as it sounds, it can make a region more brittle, and more prone to fracture.

    - **Proposed Action:** encourage National Science Foundation: supported research into the potential limits to growth in regions with constrained

water resources, dynamics associated with hardening of demand, and potentially useful adaptation strategies.

- *Water Resources Research Act*: continued support of funding for the state-based Water Resources Research Institutes, including the New Mexico WRRI housed at NMSU. These institutes provide independent, basic and applied water research that is useful in their regional watersheds.

    - **Proposed Action:** Senator Udall will continue to be one of the bipartisan coordinators of the annual budget requests under the WRRA, and support legislation to reauthorize the program and fund through the USGS.

- *Climate Adaptation Strategies:* the U.S. Department of Interior (DOI), U.S. Department of Agriculture (USDA), U.S. Environmental Protection Agency (EPA), and other federal agencies are cooperating in adaptation strategy planning for federal lands. They are also providing assistance to state and local government for water infrastructure adaptation planning. These efforts are in a relatively early stage, and comprehensive strategies to plan for water resources management have not yet been implemented.

    - **Proposed Action:** Federal efforts should be hastened along with increased coordination with regional, state, and local governments and water users affected by federal water projects.

- *Desalination*: the federal government has supported research into desalination technology for many years, and while progress has been made, the key issues of energy use and infrastructure costs remain significant obstacles at current prices for water in most areas. Desalination has applications for marine, brackish and produced water from oil and gas operations. New Mexico and the Southwest continue to see increasing interest in using desalination for the large brackish groundwater reserves in the state and its produced water, but not at significant volumes. It is difficult for cities and other users to count on desalination technology at its current level of development. If water supplies face greater stress, prices may support greater use of desalination, which is currently providing significant supplies to areas like El Paso, Texas. Combining desalination with solar energy or waste heat has promise, especially in remote locations with oil and gas operations.

    - **Proposed Action:** continue to support progress on desalination research and development, including the Bureau of Reclamation's test facility in Alamogordo, New Mexico. Improved assessment of existing brackish groundwater quantity and quality would aid adoption of desalination

where feasible. More uniformity in regulatory frameworks could improve disposal efficiency of concentrate, which is the salt solution remaining after production of treated water, and could ease adoption of desalination technology.

II. WATER SECTOR INFRASTRUCTURE

Municipal and Regional Water Utility Infrastructure Funding

Water utilities in cities, small towns and rural areas are responsible for providing drinking water for the majority of New Mexicans. Drinking water infrastructure uses freshwater resources, either surface or groundwater, and treats it to meet the federal Safe Drinking Water Act and state standards using a variety of water treatment technologies and facilities. Water utilities then supply it to residential and commercial customers via pumping and piping infrastructure. In the smaller communities of New Mexico, drinking water is widely provided by mutual domestic water providers and private water companies. These providers receive little state assistance with their infrastructure.

Utilities are also responsible for wastewater treatment, though coverage is less than for drinking water service in small communities and sparsely populated rural areas. Wastewater infrastructure consists of sewer pipes that collect wastewater from customers, and returns it to a central location for sanitary treatment before discharging it back to the environment, usually as surface water flows. The Clean Water Act and state laws set standards for any such discharges of wastewater into the environment. Local authorities also maintain stormwater infrastructure that channels runoff from rain back to surface-water bodies to minimize flooding.

Water utility infrastructure costs are primarily covered by the water rates that customers pay, which are set by utility boards or local governments. With the enactment of federal standards for drinking water and wastewater, Congress has also provided a variety of federal funding programs over the past several decades to assist water utilities with funding, especially in rural and low-income areas. The EPA, USDA, U.S. Army Corps of Engineers (USACE), and the Indian Health Service have all provided such assistance over the years, some through congressionally directed funds for specific local projects.

With existing federal budget challenges, and congressional spending reform, direct grant funding is very limited at the current time. USDA may still provide modest grants in rural areas for projects with urgent needs, and the Indian Health Service provides grants for Tribal governments. The vast majority of funding is low-interest loan financing. EPA provides funds to the states to capitalize State Revolving Funds and USDA offers direct grants and loans through state Rural Development offices.

- **Proposed Action:** encourage recognition that the federal government is unlikely to provide large grants to construct or rehabilitate water utility infrastructure in the future and encourage local utilities to budget for the long-term.

- **Proposed Action:** enhance effectiveness of existing federal low-cost loan programs, including modest grant portions for low-income areas with limited resources. Effectiveness of loan programs include better cross-agency coordination with USDA, streamlining paperwork to prevent delays and increased costs, and encouraging EPA-state cooperation to ensure federal funds are turned around quickly to local utility recipients.

- **Proposed Action:** update the federal funding formulas to account for shifts in population since the most recent amendments of 1986 and 1996 are out of date. This should lead to increases in funding for many western states that have seen population increases, including New Mexico. For example, legislation considered in the Senate in 2009 would have increased New Mexico's share from 0.5% to 0.75%.

- **Proposed Action:** while reducing loan and project preparation periods, federal loan programs can be used to ensure improvements in local utility practices and regional collaboration for developing sustainable systems. Without large federal grant funding, water utilities and communities will face the actual cost of their water infrastructure in the future. For example, utilities should conduct sound asset management, and only construct assets that they will maintain through their rate base. Utilities should also have long-term planning on rates and conservation actions when accessing federal loans or funds to reduce waste and reflect the value of this essential resource. A long-term business plan tied to the growth level of their community is also important, where their rates support the operation, maintenance and replacement of assets. In addition, some water utility infrastructure projects are local projects chosen and built without taking other regional infrastructure and plans into account. Regionalization can provide an opportunity to improve infrastructure, achieve economy of scale to lower overall costs, and implement conservation and best management practices.

Water Quality Standards

As a result of the passage of the Clean Water Act and the Safe Drinking Water Act, with the last major amendments in 1986 and 1996, respectively, the nation's wastewater and drinking water quality has improved. Treating wastewater before discharging it to the environment and treating water before sending it to customers for consumption is essential to public health. The costs of treatment to utilities, however, are increasing due to higher energy costs, population growth, and

increasingly strict standards for contaminants. Some local private utilities and governmental utilities feel burdened by "unfunded mandates" to meet updated federal standards without federal funding to cover the costs. These effects are especially felt by small private non-profit and for-profit water and wastewater companies with limited access to funds to pay for compliance and with a limited customer base from which to collect the cost of compliance through utility rates.

- **Proposed Action:** improve the link of federal funding opportunities to federal water quality standards. In New Mexico in particular, many utilities are struggling to comply with arsenic contaminant standards, given that arsenic is a naturally occurring contaminant in many areas. The reverse osmosis treatment technology used can be very expensive and energy intensive, and recent treatment investments have had mixed success.

New Water Utility Infrastructure Technologies

Much of the water infrastructure currently used to supply, treat, pipe, collect, and discharge water and wastewater is the same technology that has been used for many decades. The focus has been on steel and concrete infrastructure during the post-WWII period where the unit price of both the water supply and the electric power needed for pumping was quite low. In the Southwest, water is becoming scarcer due to climate variability, population growth, pollution, waste, and other factors, and the cost of energy has risen significantly over the past decade. As a result, southwestern and New Mexico water utilities must seriously examine new technologies and practices to adapt to this current environment.

- *Smart Water Technology:* There is significant promise in technologies that will reduce leakage from municipal water delivery systems. EPA estimates leakage rates average around 14%, with some utilities experiencing significantly higher rates. Leak detection and system management can reduce the water consumption needed by utilities and these technologies may have promising applications in agricultural settings. The Bureau of Reclamation has an existing WaterSmart program that provides grants for system improvements and EPA is encouraging utilities to address these issues to improve sustainability.

    - **Proposed Action:** Further enhancement and funding focus on these programs could advance these goals, as well as federal agency outreach, education, and procurement. Issues to be addressed include: consumer acceptance of better monitoring technology, and a life-cycle understanding and accounting of water "savings."

- *Desalination:* In desert areas with access to salt water either from the ocean or from underground non-potable aquifers, such as in New Mexico, desalination has been a tantalizing proposition for many years. If desalination technology could

overcome its high energy costs and waste production issues it could become a very popular solution in many areas. Desalination technology is in operation in several locations in the Southwest, including El Paso's water utility and the Bureau of Reclamation's Brackish Groundwater National Desalination Research Facility in Alamogordo, NM.

- **Proposed Action:** At large scales, the energy and waste issues associated with desalination remain obstacles in today's environment, when compared to costs of various efficiency measures in meeting municipal needs. Long-term sustainability needs to be further discussed for landlocked operations that are mining a brackish, non-renewable aquifer. Development of modular projects that can use renewable solar or geothermal energy should continue as they are the most promising outlets for desalination development.

- *Reuse:* Another growing trend in water infrastructure is reuse of wastewater for potable or grey water purposes, such as for watering parks. The reality is that almost all areas that rely on surface flows are reusing water that has been treated upstream. Water reuse includes re-injection of treated wastewater into aquifers to further store and treat it, which is starting to occur in places like Rio Rancho, NM. In other cases, treated wastewater is then turned into a product and further marketed for industrial, agricultural or greenspace use. As other supply sources face limited availability and rising cost in the Southwest, more and more utilities are turning to reuse technologies. Reuse increases availability to the reuser, but not necessarily to the system. If reuse can replace aquifer withdrawals, it is more sustainable, but may reduce overall near-term flows into a system. A certain type of reuse may degrade (or upgrade) the quality of ultimate discharges. Reuse is relatively under-utilized, and many aspects of reuse implementation are poorly documented; these include impacts on receiving aquifers, regulations governing quality and quantity of reuse, and policy implications of reuse.

  - **Proposed Action:** While reuse should be encouraged at various governmental levels, it is important to distinguish between consumptive and non-consumptive uses. More information will improve local decision-making, particularly documentation of impacts, regulations, and policy implications.

- *Alternative Energy:* One of the major costs associated with providing water is the associated energy costs involved in pumping and treating. Utilities in the Southwest are increasingly using solar energy to limit power costs. Various water infrastructure entities, including Elephant Butte Irrigation District (EBID), are pursuing the use of low-head hydropower in existing channels. Unlike other

renewable energy, hydropower faces a relatively stringent licensing process, designed to protect natural waterways.

- **Proposed Action:** Senator Udall has co-sponsored legislation in Congress, S.629, the Hydropower Improvement Act of 2011, which would create an easier process for licensing in man-made irrigation channels and water pipes.

- *Green Infrastructure:* Stormwater infrastructure makes up a significant part of local government water infrastructure. This infrastructure collects stormwater runoff and channels it through pipes and ditches to water bodies, preventing flooding. Pavement and concrete conveyances, however, reduce absorption and speed up discharges, creating flooding when too much water hits in a shorter time frame than designed. Increasing the amount of green space, porous pavement, green roofs, and vegetation in key areas increases aquifer recharge and slows flows to levels that can be handled by the existing stormwater infrastructure, thus reducing flooding risk. Green infrastructure cannot increase overall water supply, but it can increase local supplies via recharge and retention, and thus opportunities for reuse. Green infrastructure can also improve water quality for eventual discharges through actions of vegetation, and has promise in the wastewater and drinking water sectors.

  - **Proposed Action:** At the federal level, Congress has required 20% and 10% set-asides for green infrastructure in EPA's Water State Revolving Funds in various years since 2009. Senator Udall is the sponsor of the Green Infrastructure for Clean Water Act to require EPA to conduct outreach and incorporate green infrastructure into permitting actions. These initiatives can be continued and enhanced.

Water Supply Infrastructure

Water supply infrastructure is used to refer to the dams, levees, irrigation district systems, and pipelines that manage the flow of surface water. Much of this infrastructure was designed to store and distribute water in a regular, reliable way for the benefit of agricultural production in the arid lands of the American West. On the federal level, infrastructure constructed for agricultural water is constructed and managed by the U.S. Department of the Interior's Bureau of Reclamation (BoR). The U.S. Army Corps of Engineers (USACE) constructs and is responsible for numerous dams and levees, as part of their primary mission of flood control. New Mexico and other states also have constructed dams, and growers' organizations such as EBID, Middle Rio Grande Conservancy District (MRGCD), and Navajo Agricultural Products Industry (NAPI) take responsibility for water supply infrastructure. Along the U.S.-Mexico border, the

International Boundary and Water Commission (IBWC) is responsible for the water supply infrastructure of the Rio Grande.

These water supply infrastructure systems are managed on the Rio Grande and Colorado River according to interstate compacts and the 1944 Treaty with Mexico, which divides water rights among the states and Mexico. Each year allocations are determined based on precipitation and reservoir levels, and then allocated further within states according to state laws. The federal and bi-national agencies are required to coordinate their actions in carrying out the allocations.

In the first half of the 20th century, the federal government authorized and constructed numerous water supply projects throughout the West and several in New Mexico. Since then and in the foreseeable future, new federally funded water supply projects are expected to be much more limited. The majority of current and future projects, both in New Mexico and nationally, are those that meet tribal water settlement responsibilities.[1] Future water supply policy will thus likely focus on maintaining and optimizing the use of existing infrastructure, limited new projects, and more flexible use of existing assets for shared purposes of agricultural water and ecosystem health.

- **Proposed Action:** continue the federal government's progress in meeting its trust responsibility to Tribes and Pueblos by finalizing water settlements and funding necessary infrastructure. Ensure that infrastructure associated with such projects does not degrade the environment and alternative infrastructure supply options are considered. Continue to encourage Congress and the Administration to fund New Mexico settlements in future budgets and appropriations legislation as they have done in the past.

- **Proposed Action:** better manage existing dams and reservoirs in order to maximize both agricultural and environmental water needs. The two purposes are not mutually exclusive – water in the river is used for environmental purposes and it will eventually be used as agricultural water downstream; water used for agriculture (especially through flood irrigation) makes its way back to the river system where it can meet environmental needs downstream. Further study is needed to determine whether and how these federal reservoirs might be managed independently or as a single system; specifically, to provide optimal conservation of water for the several beneficiaries, a drought reserve for the system, and enhanced water availability for consumptive users, agriculture and the environment. Existing project authorizations and state law may provide authority

[1] These include the Aamodt and Abeyta Settlements, the Animas-La Plata Project, the Jicarilla Apache Rural Water Systems Act, the Navajo Indian Irrigation Project, the Navajo Water Settlement and Eastern New Mexico Rural Water Project.

for such operational changes, but amendments to existing authorizations to these projects could be considered if statutory obstacles prevent greater coordination.

- **Proposed Action:** encourage better coordination with agricultural water releases among the U.S. states as part of river compacts with IBWC, which handles water releases for Mexico. In 2012, early releases of water for Mexico, due to drought conditions, led to greater losses of water through bed seepage, than when the releases for Mexico, Texas, and EBID are combined. A lack of communication and coordination resulted in controversy that should not be repeated.

- **Proposed Action:** Encourage greater scrutiny from the scientific community, water planners, and the public of the large water projects that involve intra- and inter-basin transfers. This will better serve communities as well as provide more opportunities for rigorous technical assessment by the scientists, engineers, water planners and economists in the planning and evaluation, especially when such large projects are subsidized by federal and state taxpayer dollars. Some future projects are still potentially possible in New Mexico, such as within the Arizona Water Settlement Act (AWSA) and Ute Pipeline Project. The Ute project has been funded and is proceeding. However, completion is many years away. It has local support, but ongoing concerns and issues remain.

  While the Ute project, now underway, will likely continue, the trajectory of the AWSA is uncertain. A transfer project under the Arizona Water Settlement involving the Gila River has experienced halting progress. Locally preferred options for watershed and river management to meet AWSA goals are being promoted, yet larger scale water transfer projects have faced significant controversy. While some funding is guaranteed for the Gila River water projects, tens of millions of additional federal appropriations would be needed for a large-scale transfer project, and such funding is unlikely to be forthcoming in the near term. Any Arizona Settlement project should not move forward without cost/benefit analysis, feasibility studies, full exploration of economic need, ecological study and full consideration of all proposed alternatives for use of settlement funds and water.

III. WATER TRANSFERS AND WATER MARKETS

One of the most promising but controversial ways to better meet competing water needs in the Southwest in the context of increased drought and greater scarcity is the use of water transfers and water markets. For the vast majority of commodities—oil, gas, timber, metals, foodstuffs—market prices drive allocations of resources to the highest economic value user. In many agricultural settings in New Mexico, water is considered a public good or community resource.

However, with increasing demand and competition, water is being transformed into more of a commodity.

In the Southwest today, surface water is allocated to agriculture according to long-standing precedents and laws governing water rights. In most municipalities, water is provided to consumers on an equal access basis at regulated prices by governmental or quasi-governmental agencies, or private contractors in some areas. Many rural residents use their own groundwater wells. Groundwater laws and rights are more recent, but access and transfers are fully regulated by state law in New Mexico and other western states.

As the cities in the Southwest have grown, they have acquired significant water rights over the years from agricultural interests, reducing the amount of irrigated land and increasing urban areas in the process. Most of these transfers have been permanent, and are the result of unique, one-time negotiated deals, the terms of which are often not fully transparent to other parties. These transfers are often of surface water rights, but groundwater rights may be transferred as well. Proposed water transfers of groundwater outside a basin are currently the subject of great interest in New Mexico and elsewhere, as the ultimate users and purchasers of the water are yet unknown. Local rural areas are concerned about transfers of groundwater out of their areas and the potential impact to their own wells.

While in the past, the most common water transfer has been from agriculture to municipal, there is growing interest in water transfers for environmental benefits. These transfers are different in that the environmental purpose—instream flow—is not entirely consumptive, and thus water remains for use downstream (though water for riparian habitat may be similar to agricultural water use). They also differ in that they may be most useful on a temporary, rather than permanent basis, such as during droughts or seasonal periods. The federal government has a strong interest in both temporary and permanent transfers under the Endangered Species Act (ESA), where water is needed to preserve at-risk aquatic and dependent bird species that are particularly stressed in times of drought.

Water transfers are controversial for several reasons. In many basins, water rights are not fully "adjudicated" so it is more difficult to make a transfer of title work when not all water rights are fully determined under the law. Full adjudication is not likely to be practical in a reasonable time frame so provisional arrangements may be needed. Contested tribal water rights in particular represent an obstacle to such transfers, if they conflict with the federal government's trust responsibilities to settle their rights. However, they can also serve as a critical tool for helping to settle longstanding conflicts over such rights on a voluntary basis. Additionally, in areas where water rights are held by a large number of agricultural users, each with a small share (such as an acequia), individual sales by willing sellers may undermine the community base of support necessary to maintain agriculture in the area for the water right holders that remain, unless those concerns are affirmatively addressed. This loss of irrigation system viability is particularly acute for acequia systems where ditch-wide sharing of water can be undermined when (1) not enough

water is available to move irrigation flows to the end of the ditch; or (2) when water transfers lead to residential developments that physically block or remove connecting sections of ditch.

Many rural residents are also concerned that water transfers and markets will irrevocably lead to the further erosion of sustainable, rural, agricultural communities.

Since water transfers exist, albeit often in poorly operating markets, it is worthwhile to pursue policies which can maximize their benefits of sustainability for all users while minimizing negative, irreversible impacts.

- **Proposed Action:** Promote temporary water transfers for instream flows in order to preserve agricultural water rights while maximizing the potential for transfers for environmental use. Pilot transfer programs are a logical way to develop best practices that can help to shape more permanent transfer arrangements on a voluntary basis.

- **Proposed Action:** Promote transparency and facilitation of transfers for water rights that are adjudicated. Temporary transfers are especially important where existing rights are not fully adjudicated. Voluntary water transfers are preferable as local, collaborative efforts can achieve desired outcomes while minimizing impacts to users. All water transfers must be voluntary. The state government is primarily responsible for reducing bureaucratic barriers to transactions, although the federal government can also play an instrumental role in facilitating and funding transfers in federal projects.

- **Proposed Action:** Utilize facilitated, temporary water transfers as a solution under the ESA and for Tribal water settlements, to avoid the need for more onerous "command and control" regulation to protect threatened and endangered species or to resolve other longstanding conflicts. Such transfers from irrigation districts to address the needs of listed or candidate species should include "safe harbor" type assurances, similar to voluntary Candidate Conservation Agreements with the Fish and Wildlife Service (FWS). These transfers should, however, focus on ecosystem benefits (such as river and riparian health), rather than on a single species.

- **Proposed Action:** Enhance safeguards for water transfers with irreversible, potentially negative impacts on rural communities, agriculture, and the environment. Water transfers may need regulation or authority at the irrigation district or acequia level to ensure system integrity. Prohibitions on out of state transfers should be maintained and inter-basin transfer should continue to receive a high level of scrutiny.

- **Proposed Action:** Use of federal funds for water transfers can increase achievement of federal environmental goals, and also drive improvements in the transparency and functioning of water transfers, by offering funding as a reward for voluntary participation. Water transfer authority and support of qualified local entities to facilitate transactions should be considered for inclusion in the budgets of BoR, the USACE and IBWC and authorizing legislation. Local issues, local expertise and local control remain very important and it is equally important for federal agencies to understand them in detail.

- **Proposed Action**: Pursue methods for streamlining water rights adjudication at the state level. This could include state legislation that places limitations on adjudication options or creates special state district courts or processes for adjudication cases.

IV. ENVIRONMENTAL RESTORATION & WATER QUALITY

In addition to concerns regarding existing and future surface water supplies and infrastructure, it is also important to maintain and restore healthy river ecosystems and instream water quality. In the late 19th and early 20th centuries, western rivers were almost exclusively managed for their agricultural purposes, flood control, and human development. In recent decades, society has also valued maintaining living rivers, and there have been ongoing efforts to restore riparian habitat and water quality necessary to support diverse aquatic and land-based species—plants, fish, birds, and mammals such as elk. In concert with treatment and riparian conservation, greater scientific understanding of watersheds is leading to forest headwaters restoration projects to improve habitat and water quality within the basin.

Instream water quality: The Clean Water Act sets safety and environmental standards for the composition of surface waters that fall under the Act, interstate waters and those waters with a "significant nexus" to interstate waters. This includes some wetlands and intermittent waters, according to the most recent Supreme Court decisions on the topic. Major point sources of pollution, such as industrial, municipal, and some large agricultural producers are directly regulated by permits from the state or federal government. Diffuse "non-point" sources are covered in less direct and more diverse ways, including public outreach, design standards and local ordinances. Instream water quality—the number and amount of potentially harmful contaminants—has obvious importance for drinking water sources, agricultural irrigation, biodiversity, and ecosystem health.

- *Water quality impairment:* Almost one-third of New Mexico's assessed stream miles have water quality impairment. Watershed restoration and protection have

the potential to mitigate and prevent water pollution. Funding of Clean Water Act authorities can assist communities in implementing restoration.

- *Salinity control:* One of the major water quality challenges in the Southwest is the high levels of salts or dissolved solids in instream water. Elevated salinity reduces water's suitability for agricultural uses and increases the amount of treatment necessary for drinking water. Salinity levels are influenced by both man-made and natural factors that vary depending on the area, with pasture and cultivation significant contributors in some areas, according to the USGS. Research from the New Mexico Environment Department (NMED), the New Mexico Interstate Stream Commission (NMISC) and universities indicate that natural causes are the principal factor along the Rio Grande in New Mexico.

  Salinity levels can be reduced by water supply management actions and salinity-control projects that improve irrigation or limit high salinity discharges into waters. Different mitigation efforts may be more or less appropriate in different areas. The Colorado River basin has a well-organized salinity program under the Colorado River Basin Salinity Control Act of 1974, involving the BoR, USDA and Bureau of Land Management (BLM) and the multi-state Colorado River Salinity Control Forum. In 2007, the USGS found that salinity control projects had made progress in reducing salinity in many areas downstream in the Colorado Basin. The Rio Grande Compact Commission has formed a Rio Grande Salinity Management Coalition, with the Lower Rio Grande as a reach of particular concern. The USACE has begun a Rio Grande Salinity Management Program under the 2007 Water Resources Development Act. The Pecos River also faces acute salinity management challenges.

  Proposed Action: continued research is needed on the causes and nature of Rio Grande and Pecos salinity issues, focusing primarily on the link to cost-effective salinity control projects so that growing coordination and management efforts know where to focus resources. Additionally, funding the USACE's program should continue beyond the first phases for the Rio Grande and Pecos River assessment and control projects from a variety of funding sources.

  While the natural causes may not be reversed, agricultural practices upstream may improve the quality of water for downstream agricultural and other uses. Other approaches, such as interception of saline tributary flows, may improve downstream water quality but reduce the volume of available water. Measures should be taken to ensure that water rights are not impaired in quantity to make downstream improvements in quality.

Watershed Health: At a broader level, instream water quality is affected by any major landscape change inherent to large urban or agricultural areas, such as through major timber, mining, or energy development. Other factors that determine the runoff rate as a percentage of precipitation in a watershed include: the amount and type of vegetation cover, agricultural use, structures and pavement with impervious surfaces, and the type of substances on the surface, storage in depressions and reservoirs, riparian buffers that impact flow, and groundwater aquifer characteristics, including connections to streams. Standards on these activities are primarily set by local zoning or conservation districts. A narrower or indirect impact is influenced by larger state or federal government decisions, such as industrial permitting or endangered species actions. Any effort to manage or improve water quality and environmental restoration must account for a variety of factors, including erosion and sediment management, salinity control, invasive species, and the relationship between federal and state water quality standards and conservation efforts.

- *Invasive Species:* When it comes to water supply, the primary invasive species of concern are the tamarisk/salt cedar, Russian Olive, and other phreatophytes that thrive in salty, dry soils by tapping groundwater. Many private landowners, non-profits, and government agencies at all levels are conducting removal and control actions using mechanical and chemical methods. There are concerns that the water savings of tamarisk removal are unknown, and if that could be determined it could be weighed along with other conservation or water supply efforts. In addition, the tamarisk beetle, which feeds on tamarisk, has been introduced in neighboring states to control the trees and preserve water for other beneficial uses. The beetle has now been found in New Mexico along both the San Juan River and in the Rio Grande Basin north of Albuquerque. The final impact of this release is unknown, with some areas seeing success, but others voicing concern of fire risk, lack of certainty on native re-colonization, and the potential of endangering willow fly-catcher habitat.

  Proposed Action: Balance invasive removal efforts with an emphasis on restoration of native plants and the river processes that sustain them. Increase coordination of tamarisk and other invasive removal efforts and river restoration among agencies and private landowners in manageable watershed units.

  Proposed Action: With the beetle acting as an uncontrolled experiment in New Mexico, further research into the potential negative side effects is urgently needed, in order to plan further mitigation activities. Interstate planned introduction of invasive species should also receive greater federal scrutiny.

Proposed Action: Support the efforts of the Sevilleta Long-Term Ecological Research (LTER) Program that is currently measuring long-term patterns of tamarisk water use under varying climates and hydrology.

Proposed Action: Expansion of research into water consumption by non-native and native phreatophytes should be supported to improve the understanding of effects of vegetation management on river basin hydrologic budgets.

- *Integrated river basin management:* Diverse government bodies and jurisdictions within river basins in New Mexico make coordinated planning and implementation challenging. Various organizations and forums exist to discuss these issues but most have a specific focus, such as protection of endangered species or water delivery among states and not overall planning. Nationwide, large watersheds have developed formalized programs, such as the Great Lakes and the Chesapeake Bay, to address the coordination issue and seek and use limited conservation funds more effectively. These programs incorporate various river basin commissions that plan and manage deliveries, but also incorporate land use and conservation projects.

  Proposed Action: Enhance collaboration between states, different agencies, and water users within basins such as the Rio Grande and Pecos River basins. Build upon and tie together existing efforts, such as the Compact Commissions, Endangered Species Collaborative, state water agencies and plans, and conservation efforts like the Rio Grande Environmental Management Program. A federally chartered program for these basins could be authorized via legislation, on a consensus basis among the state delegations. This is an ambitious effort and should start with voluntary and coordinating efforts to build trust, which is especially important in the current environment. Use integrated river basin computer simulation modeling developed with multiple stakeholder involvement to evaluate consequences of various future water management strategies.

  Proposed Action: Continue implementing the Secure Water Act's Basin Study Program. Even with existing divided management of water resources in major basins, integration can be improved with better information. The Secure Water Act, enacted in 2009, has funding for basin studies and water assessments to give planners and stakeholders better information about how much water is available. The Lower and Upper Rio Grande studies were initially funded in 2011 and the Pecos in 2012, with federal and state/local cost-shares.

- *Riparian and watershed restoration projects:* A diverse group of governmental and non-profit organizations and private companies are funding and implementing riparian and watershed preservation and restoration projects. There appears to be

much more demand than funding in the current environment, especially following the recent catastrophic wildfires in the West. These efforts are not necessarily coordinated or part of a broader plan for watersheds. The Rio Grande Environmental Management Program is a recent attempt at coordinating and funding these efforts, but it has not yet been funded.

- **Proposed Action:** Protect federal funding for river/ecosystem restoration in the budget process. Federal funding is available for land acquisition through the Land and Water Conservation Fund (LWCF), which can include associated water rights. Other land conservation funding comes from federal agencies such as the BLM and USDA, the National Fish and Wildlife Foundation (a non-profit chartered by Congress), and a variety of other sources. Most of these organizations focus on land conservation, but for southwestern rivers in drought, more conservation resources could be focused towards water acquisition or temporary transfers for environmental flows and conservation. One option that could be pursued would be to use state legal provisions such as those found in instream flow laws. These provisions allow water rights owners to temporarily release their water for instream uses as a beneficial use, or to abandon their water right and dedicate that water to instream use. However, New Mexico does not have an instream flow law and therefore has fewer options for temporary transfers than surrounding Western states.

- **Proposed Action:** Provide non-structural green infrastructure approaches for flood control along with traditional levee-based protections. Restoring the natural channels for rivers increases riparian habitat. Many riparian habitats have been significantly altered by the channelization for flood control purposes. Under USACE reforms enacted by Congress in 2007, more analysis is now used to ensure that non-structural options are considered and implemented where appropriate. Several stretches of levees in New Mexico will need reconstruction in coming years. Amendments to existing authorizations for these flood control projects could be considered if statutory obstacles prevent adequate consideration and construction of non-structural green infrastructure.

- **Proposed Action:** Flood control can, in some areas of the state, be coupled with storm water capture and re-use, thereby adding to the benefits and economic performance of infrastructure investments. Institutional barriers, such as some requirements of the Clean Water Act, may need to be relaxed in order to support and encourage creative storm water management to best fit hydrologic conditions and user opportunities.

V. AGRICULTURAL PRACTICES

As late as the 1950s New Mexico was largely self-sufficient in terms of food production for human consumption. The development of the interstate highway system, expanding food production in California and other states, and the increasing centralization of food distribution across the United States made the importation of food to New Mexico economically viable. Since then, much of the agriculture in the state has transitioned to forage crops for livestock. This makes an important economic contribution throughout the state. However, future energy prices and overall economic conditions may one day make cultivation of human food crops in New Mexico much more important than it is today. Maintaining agriculture in the state for the future could one day mean greater food security for New Mexico citizens.

Agriculture is the largest user of water in the Southwest and New Mexico by a wide margin. If water supplies become scarcer—and/or population and economic growth lead to greater demands for water in other sectors—improvements in agricultural efficiency or changes in regional agricultural practices may provide a promising solution. However, the place of agricultural water in the overall water cycle is complex, and the ultimate impacts of proposed changes should be understood beforehand.

- *Crop changes:* Different crops use different amounts of water and produce different values. In the West, one of the more common, relatively high consumptive use crops is alfalfa hay. Making changes to different crops is challenging when feed crops like this are low-risk, easy to produce and have ready nearby markets in local cattle and dairy producers. Furthermore, farmers producing these crops often have senior water rights and little incentive to reduce use by switching to a higher value, but riskier crop, which can lead to loss of water rights over time. It is also important to realize that while water is a significant factor in a farmer's crop choice, it is one factor among many that is considered.

    - **Proposed Action:** Agricultural producers are good at adapting over time to new developments, including changes in water supplies and climates. These producers often prefer not to have to adapt to changes in policy. In the U.S. agricultural economy, crop-specific mandates are unsuitable and should be avoided. Better market signals to the agricultural economy could produce better value-based decision making on behalf of individual producers. Existing regulations and incentives should be re-examined to ensure that they do not needlessly encourage or subsidize such crops at the expense of others that may provide higher value.

      As discussed in other sections, water is not clearly valued in a market and doing so across the agricultural, municipal, and industrial sectors could have

far reaching, permanent impacts that eliminate long standing rural communities. This would reduce rural representation in political decision-making, creating a negative feedback loop for agricultural communities. In contrast, encouraging optimization of water management for multiple purposes and temporary water transfers *within* agricultural and environmental sectors is a promising alternative. This could introduce better market signals while keeping water available for agriculture and the environment, in potentially mutually beneficial arrangements.

- *Irrigation Practice Changes:* Many arid areas have seen a shift from flood irrigation to drip irrigation systems to reduce the amount of water needed to produce the same value of crops. These systems require an upfront cost, which can be recouped based on improved yield and quality. Additionally, in some areas where absolute scarcity is reducing the deliveries to irrigators, a shift to drip irrigation systems can allow them to maintain higher yields. However, local evidence indicates that current flood irrigation practices along the Rio Grande reduce salinity and recharge aquifers. If irrigators withdraw the same amount of water from a river, but use it more efficiently, they will return less water, with higher salinity concentrations. There is an efficiency conundrum, because using more water for consumptive plant use leaves less water for hydrologic and environmental services of percolation and seepage.

    - **Proposed Action**: Improve and expand current instream flow opportunities that allow water users to lease, loan, or permanently release unused or unneeded water for dedicated use as instream flow.

    - **Proposed Action:** Drip irrigation may be appropriate for some growers who are not receiving the necessary water for flood irrigation on the same yields. But in a "use it or lose it" water rights context, greater efficiency means more yield, and greater consumptive use. Promoters of drip irrigation must focus on where water savings from irrigation practices go, and how to implement the practices for what purpose. Policies and regulations to enhance conjunctive use of surface water and groundwater could help ease the conflict between irrigation efficiency and ecosystem benefits of unconsumed water.

    - **Proposed Action:** New Mexico and irrigation systems in the West have also seen some upgrades in infrastructure to avoid leakages in ditches. Covered ditches can reduce evaporation and increase the amount of water available for irrigators, all things being equal. But, again, more efficient irrigation systems are likely to increase consumptive use but may reduce return flows. Additionally, they may increase salinity if they also reduce seepage back into riverine aquifers and no "savings" are applied for transfers to environmental

or other agricultural uses. State and federal programs aimed at improving irrigation efficiencies, such as those implemented by the Natural Resources Conservation Service, should be maintained and broadened.

- *Water market changes:* When the full agricultural hydrologic cycle is taken into account, along with the water rights rules that drive the incentives of individual users, it becomes clear that large-scale changes in crops and irrigation should be part of a broader water reform effort. This ensures that water savings are applied in a beneficial way. Without a way to temporarily transfer water savings to other users, irrigators have little to gain from reducing absolute consumption. In times of drought, these potential savings represent real opportunities to address scarcity for other agricultural users, as well as instream environmental flows (which are sometimes mutually reinforcing). Mechanisms for instream environmental flows are rudimentary in New Mexico and may limit aquatic ecosystem management options.

- *Intersectoral transfers of conserved irrigation water:* Most agricultural water conservation practices do not aim to reduce the depletion of water by crops, but rather to reduce the non-consumptive losses such as canal seepage and deep percolation. The reduction of applied water through reduced non-consumptive losses may interrupt recharge processes if the "conserved" water is moved to another use or location. The effect can be masked for a time by reduction in groundwater storage, but longer term negative consequences must be considered.

    - **Proposed Action:** Any federal efforts to incentivize more water-efficient crops or irrigation systems should take these factors into account. Funding then may provide an incentive for states to provide avenues for transfers that are acceptable to irrigators and communities—especially temporary transfers during times of drought. As noted elsewhere, water transfers can be highly controversial when water rights are withdrawn from agricultural use or transferred from one basin to another.

VI. WATER CONSERVATION

"Do more with less" is a common sense response to scarcity of any resource, and water conservation is an ongoing goal especially in the municipal and commercial sectors. Federal agencies such as the EPA, state agencies like the New Mexico Office of State Engineer, local water utilities large and small, non-profit organizations, businesses, and many individual citizens view using less water as both the smart thing to do to save money and the right thing to do with a scarce resource needed by all to survive. Much progress on water conservation is underway in the U.S. broadly, and in New Mexico in particular, with some success in terms of lowering per capita use of water. However, water conservation efforts need to be considered holistically for all

their effects since water conservation and efficiency can be either absolute—less water used—or relative—less water used in one instance leading to equal or greater water use overall. One consequence to water conservation is that it can allow for new and other uses of the conserved water leading to a "hardening of demand," where users learn to adapt to less water by using less. The problem arises when periodic scarcities occur, but there is no longer any room for any greater conservation or greater reduction in demand. This can create a human system that is more fragile and more prone to fracture and collapse of one kind or another.

- *Municipal water efficiency:* Arid and developed areas in the United States have higher per capita municipal use rates than similarly situated developed areas elsewhere in the world (such as in Israel or Australia). In addition to fixing leaky infrastructure, municipal efficiency can be increased through more climate appropriate landscaping, more efficient appliances, and behavioral changes. Utility water pricing will also drive conservation by commercial and residential users. Conservation of municipal water use allows for extension of existing infrastructure, reducing local costs. Conservation also allows for continued growth in areas with limited water rights and availability. It is unlikely that major municipal water efficiency efforts will meaningfully increase water supplies for other users in the system, however. Municipal use makes up 6% of the water use in New Mexico, so municipal conservation does not provide huge supply benefits long-term.

    - **Proposed Action**: Consideration should be given to using aquifer injection or other storage to set aside conserved water for times of scarcity, rather than always allowing conserved water to be allocated to further growth in water consumption by default.

    - **Proposed Action:** All arid municipalities should improve efficiency in order to prudently prepare for future shortages in times of drought and climate change. In an emergency, where there are no "savings" and the response is rationing of existing supply, citizens tend to support strong efficiency measures.

In times of adequate supply, local water managers must show that conservation has a purpose. Users will want to know where the "saved" water is going. For municipalities that wish to grow, conservation already is a cost-effective option in many cases and will likely improve its relative future costs compared to obtaining new water rights or drilling new groundwater wells. As an additional benefit, conservation does help preserve agricultural uses at the margin. Conservation of groundwater pumping extends the life of wells. Environmental flows are a benefit but require public acceptance and/or funding to drive municipal conservation.

Overall, the linkages and beneficiaries should be clearly understood, and value allocated accordingly. For example, if a city wishes to expand and provide water to a new development,

the developers may compensate existing water users' conservation efforts to more directly link the costs and benefits. As with irrigation efficiency, there is a conundrum with conservation. Conservation does not create new water supplies to address supply variation and scarcity. Conserved irrigation water is used for more crop production and conserved municipal water is used for more house construction, largely because of the use-it-or-lose-it legal backdrop. Current efforts often simply cite conservation as a virtue, not an incentive, which may limit mass adoption and effectiveness.

Fewer concerns exist regarding the scarcity in arid areas at the national level. Improving appliances through mandatory and voluntary standards like the WaterSense label will limit costs of sustaining a growing population with finite water flows. Limiting leakage from water systems through smart water efforts and water reuse efforts will be driven by local concerns, but the federal development and standardization efforts will help those who want to access them.

VII. WATER RESOURCE PLANNING

The institutions for managing water infrastructure, supply, and planning for future water scenarios become even more important in times of scarcity. Persistent drought, whether through natural cycles or human-induced climate change, may severely test these institutions and organizations in the years to come.

As many have observed, the distribution of the major surface waters in the Southwest—Rio Grande, Colorado, Pecos—was determined during a time of plenty and in areas with much different populations, economies, values and distributions than exist today. Federal agencies are responsible for managing their infrastructure in a way that spans watersheds, but local management and policy is determined by states and units of local government, including water districts, which do not match up with watersheds.

These existing water management organizations are primarily focused on managing within sub-basins, for the current and upcoming water year, and on the long process of determining rights and responsibilities based on the past. Planning for the medium and long-term future at a regional or basin level is a lower priority, especially when budgets are tight and water tensions are high. Management and planning also typically occur within certain stakeholder jurisdictions—agricultural water supply organizations plan, cities and towns plan, and large industrial users plan, but not necessarily as part of the same process. As a result, conflict can often arise during scarcity as managers and planners look outside their jurisdiction to make up shortfalls.

- *Water Storage:* The historical way to manage water scarcity in the West has been the numerous dams and reservoirs to store water during wet times and release it during dry times. At this point, the major focus is on maintaining the existing water storage system. No major new water storage projects are likely on western U.S. rivers due to cost and environmental concerns. There are no other feasible

ways to store large volumes of surface water, and reservoir evaporation is a significant problem in extended dry times, with large loss factors.

The only other option in more local contexts is aquifer storage, where water (often re-used wastewater or other resource) is injected into the groundwater aquifer for later withdrawal. The City of Rio Rancho is conducting injection storage of treated wastewater, as is the Albuquerque-Bernalillo water utility, and NMED expects future projects in New Mexico.

Proposed Action: Maintain federal and state reservoir capacity through operations and maintenance of aging infrastructure. Improve the effectiveness of this storage capacity by ongoing improvement of water operations, such as the recent agreement to improve water management in the Colorado River Compact. Different schedule and delivery plans will have different water losses and environmental trade-offs. If the human and environmental benefits of minimizing the losses can be realized then the overall pie can increase, within limits.

Aquifer storage activities will be pursued where cost appropriate, especially as a way to increase public acceptance of re-use. State and federal permitting standards seem to be adequate at this time but may need revision if receding groundwater and water rights issues drive a major increase in the activities. Aquifer storage may reduce surface flows in some places at times and increase them in others. These water supply and environmental impacts need to be understood before undertaking the actions.

- *Intrastate Regional Planning:* Different regions of New Mexico do not always communicate on their individual water plans, and several stakeholders questioned whether the New Mexico State Water Plans are effective. This plan was first produced in 2003, updated in 2008 and will be updated again in 2013. While much progress has been made, there are many areas where the state plan can provide greater benefit, such as better coordinating regional plans that use the same water from a closed basin. One important consideration that will undoubtedly be addressed is the fact that we are experiencing significantly different water availability than in 2003.

- **Proposed Action:** Update the State Water Plan to provide: greater clarity on the state's water budget; ongoing areas of water rights adjudication and settlement; greater coordination among regions, especially within watersheds and basins; and a platform for greater state participation in interstate water organizations. A water development board distinct from but complementary to the Office of the State Engineer could help coordinate solutions by planning across multiple water

sectors. Planning efforts should be paired with new field investigations to identify potential systems for aquifer storage and recovery.

- *Regional Watershed Planning:* It is a common refrain in water policy, but there is truth to the belief that greater regional watershed planning will be beneficial. First, the act of planning and negotiating can be consensus building, or at least clarifying. Repeated rounds of planning meetings with little strategic implementation, however, can quickly become irrelevant and frustrating. At the local levels planning tends to be focused on tangible topics with authorities able to implement them, but the greatest need is with larger *intra*state and basin planning. This planning is challenging, especially given the Rio Grande Compact where the effects of drought disproportionally impact downstream users. States are going to be disproportionally impacted, so the incentives for cooperation in planning are limited.

- **Proposed Action:** Stakeholder-driven planning will focus on the key issues of the day and keep implementation processes in mind. It is difficult to plan when water rights are uncertain and stakeholders are at direct odds. Nevertheless, with New Mexico facing its worst drought in decades, stakeholders in the state need to come together at the various planning forums with an open mind and commitment to flexibility in pursuit of their interests.

  Strategic implementation of this planning ensures its benefit. A major example is the future commitments of water users and management groups, along with municipal and environmental interests, to provide flows to secure river ecosystem health and for endangered species such as the silvery minnow. In the absence of such planning, the Fish and Wildlife Service will likely implement what it finds necessary under the Act without as much local input.

  One way to encourage planning and cooperation is the joint development of a watershed model in stakeholder groups. When the underlying assumptions are agreed upon, different interests can view the impacts of various actions and changes, such as different water operation plans for the Rio Grande Compact. Sandia National Laboratories and others have experience developing these models and walking groups of users through them in a learning process, and this could be done for the Rio Grande.

  There is significant ongoing federal funding for operations and maintenance of water infrastructure in the Southwest. In the future, this funding could be used to encourage greater regional planning by prioritizing funding towards areas with successful planning operations.

- *River Compacts:* three major river Compacts affect New Mexico—the Colorado Compact, the Rio Grande Compact, and the Pecos Compact. All have been the subject of litigation over the years. Conflict is seemingly increasing in many areas as projected supplies under the Compacts are failing to materialize. These Compacts were negotiated and signed in an era with vastly different population, water use, economies, values and climate characteristics, and implementing them is challenging. As noted elsewhere, a major update was recently made to the Colorado Treaty between the U.S. and Mexico. The update included new ways to share shortages among the U.S. and Mexico, transfer water from Mexico to the U.S. in the near term (in exchange for infrastructure funding), and enhance delivery of water to the Colorado River Delta ecosystem along with expanded environmental restoration efforts.

- **Proposed Action:** The federal government could sponsor initiatives that focus on revisiting the seven or eight inter-state Compacts to update them based on current understandings of water budgets and future climate projections. This is obviously a large, complex, and likely controversial undertaking. The status quo, however, is also large, complex and controversial, as the underlying reality is changing in the river basins. The Compacts were signed when the purpose of water management was to "green the desert" for agriculture, whereas now the preservation of agriculture is one goal among many others. The Rio Grande Treaty and Convention of 1906 may be next in line for a similar attempt to update between the United States and Mexico, which could benefit water users and the environment in both nations. Short of major changes to existing compacts states, federal agencies, and water users should explore ways to update and change practices under the existing rules.

VIII. ADDITIONAL SUGGESTIONS FROM AUDIENCE:

Session 1

- Use cisterns upstream to catch rainfall to reduce flooding and recharge aquifers.
- Regarding agriculture use - take great care with water rights transfer; moving agricultural water to Mexico and elsewhere is extremely risky; regulated deficit irrigation can save significant amounts of water – agriculture must consume most water.
- Promote conservation - invest in efficient irrigation systems to market the water that is conserved for ex moving from gravity systems to center pivots.
- Restrict development - development must be accompanied by new regulations regarding water use recycling conservation. Development must be accompanied by advances in water sustainability regulations research technology. "Smart" development may mean a moratorium on development until we have a plan for the future!
- Implement wastewater treatment on Indian lands for economic development for these tribes; make agreements with tribes and support reuse.

- Conservation – Involve youth by creating sponsorships with federal, state and tribal agencies to sponsor water conferences that address water conservation strategies and help teach kids at an early age to conserve.
- Create water abuse laws and have water cops (i.e. Albuquerque Water Authority fines users for using sprinklers at certain times of days).
- Compacts from 100 years ago no longer work and we need to revisit them.
- Need a study to control the damage done to the Pecos River by Golden Algae.
- Educate the public on the value of water and increase water rates to reflect the true cost of water and the cost in providing it.
- Make link between water and other resources scarcity and population growth.
- Redo all water laws – Need water laws that are nationwide policies and those that look at whole cycle without separating surface and groundwater; we need to eliminate the rule of capture that allows landowners to take their neighbor's water; and stop policies that encourage maximum water consumption.
- Balance impacts to local, rural communities with the needs of larger cities' industrial uses of water - or more specifically, what policies could secure a balance of impacts across the landscape to assure rural water uses, environmental water is not impacted to a greater degree?
- Texas has right of capture philosophy, there needs to be consideration at a national level to end such philosophies.
- Currently water laws deal with surface and ground water separately. But surface and ground waters are interrelated. We need to look at the possibility of a total makeover of water laws based on total water cycle.
- New Mexicans have been leaders in the areas of water conservation, new technology and collaborative decision making and we need to export our knowledge skills to the many arid regions of our country.
- What percentage of New Mexico's water basin aquifers are considered mined - that is, current and future water rights are based on an "acceptable" but constantly declining water table.
- We need more enforcement mechanisms for water conservation and infrastructure improvements - there is a gap between what water distribution systems pump and what they bill.

Session 2

- We need to find out what local and regional efforts are now underway that brings diverse stakeholders together; learn from these efforts about what has worked; utilize existing stakeholder collaborative efforts and make clear goals and timelines for those goals transparent to participants.
- Look at storm water for passive aquifer recharge and figure out how to streamline the EPA policies which are cumbersome at permitting such activities. The U.S. Forest Service needs to manage forests to meet at least one of the 1897 mandates to provide favorable supplies of water. This can be mandated to implement best watershed management policies as described in many USDA publications.
- Tax each user on acre foot usage and let the State Engineer's office administer the taxation since they have the data. No exemption to cities and community wells.
- Make funding available through FEMA and the National Flood Insurance Program for watershed floodplain management for maintenance of infrastructure and flood mitigation.
- Communities that are contributing funds through the CRS program should be benefitting from some of the millions of dollars that are given through flood insurance policies.
- More cross agency cooperation to manage watersheds and regulations. EPA-FEMA; NMED-NMFMA; Industry/MS4 communities.

- Our Compacts are based on uncharacteristically wet years and our paper water obligations exceed wet water more often than not. We need to renegotiate the Compacts.
- Regarding the FSA Programs – we need programs for drought assistance to help producers in irrigation districts. In Southern NM many of the canals and laterals could be "piped" that run through producers' farms. We know that "piping" a canal can save hundreds of acre feet as well as allow producers to pump irrigation water into the pipelines that can cut fuel cost and ground water losses.
- Along the lines of Del Archuleta's talk, the state should develop methods of allocating more funding to water conservation and maintenance of systems. This funding should focus on conservation and not more bureaucracy because water and money are so scarce and both must be used effectively.
- Adopt water user fees. Use revenues to subsidize large agricultural user conversion to drip irrigation or other water conservation technologies.
- If water is the limiting resource for many proposed new business projects then more emphasis should be spent determining if the project is viable based on water needs at the onset. Businesses spend effort on other aspects of the development of the project and the public is involved in public comment but emphasis needs to shift to water availability and the impact of the proposed project as the initial step to assessing a new business development.
- Aquifer storage should be considered under Compacts as well as reservoir storage. Reconsider use of reservoirs given the high evaporation rates. Encourage crops that are lower water users to allow restoration of mined aquifers.
- The Office of the State Engineer uses unrealistic regulations to deny farmers access to their ground water rights. If you do not have an operational well on your farm you are prohibited access to your water rights. Your neighbor is prohibited from pumping for you, although this metering is available to report this pumping. There needs to be discussion about what recourses are available to the agriculture industry to work around this problem.
- The prior appropriations doctrine is the law in NM. How is it that farmers "share the shortage" rather than first in time first in right?
- Limit growth to a specific percentage per year similar to Davis, California which is at 1%.
- Resume water banks allowing those to sell their water rather than grow crops with it.
- Short term water transfers are a huge mistake. A short term expedited transfer policy is an easy and quick route to avoiding the issue of growth versus agriculture and environment.
- Green meeting practices would be appropriate to be the example of sustainable behavior (i.e. asking people to bring their own drinking cup; not using or providing water bottles).
- We should accelerate the adoption to treat household grey and black waste water so it can be reused. It's cheaper to retrofit rural residences with sewer systems than it is to build rural semi-rural region waste water treatment systems.
- There should be more transparency in whether there are any foreign interests in NM water.
- There is concern in the lower Rio Grande about how farmers can have confidence that the Office of the State Engineer has their best interests in mind if they are considered Texas as far as the compact.
- More transparency about how much ground water NM has and how long it will last.